JOURNAL NOTES

Magnetic Properties

In 1923 Niels Bohr predicted, on the basis of his theories of periodicities in the electronic structures of the elements, that somewhere near the end of the periodic table there should exist a series of elements similar to the rare earths. Some time later Sugiura and H. C. Urey, by calculations on the basis of the old quantum theory, confirmed the existence of such a series, whose stable electronic structures, they found, were those having orbital electrons of the energy state designated 5f analogous to the 4f electrons of the rare earths. Newer wave mechanical calculations by Wu and Goudsmit and later by Mayer have shown that 5f orbitals should be prominent in the uranium structure.

The f orbitals are deeply imbedded and have small perturbing effect on neighboring ions, so that in crystalline salts of such a series of elements the ions should exhibit distinctive electronic spectra and magnetic properties. Recent work at the Bureau of Standards has given spectroscopic proof of the existence of f electrons in the uranium atom's electronic structure. This paper reports measurements of the magnetic susceptibility of uranium compounds which show the existence of 5f electrons in the uranium (IV) ion.

It should prove interesting to extend such magnetic studies to other elements near the end of the periodic table and thus obtain more exact information as to just where the predicted series begins. Also the magnetic properties show interesting anomalous behavior at low temperatures and this should be investigated to learn more about the way such ions interact with their surroundings.

There is, of course, an abundance of chemical and crystal structural evidence showing similarities between the heaviest elements and the rare earth elements. Solution of these electronic structural problems will be hastened when various types of information are properly correlated. C.A.H.

The Magnetic Susceptibilities of Some Uranium (IV) Compounds. By Clyde A. Hutchison, Jr., and Norman Elliott. *J. Chem. Phys. 16: 920, September, 1948.*

Ultrasonics

Ultrasonics, a by-product of two world wars, was evolved more than thirty years ago in France when the Allies were looking for a way of detecting German submarines. Paul Langevin and co-workers at the Sorbonne worked out a device for searching out submarines by listening for echoes of an underwater sound beam they reflected. High frequency or superaudible sound was used because the short wavelengths made it more practical to originate the beam and then detect its echoes. Rutherford and his collaborators in England and American workers at Columbia University and San Pedro developed this idea, using synthetic crystals to replace Langevin's piezoelectric quartz. By 1917 scientists had a silent sound beam that could have done to German submarines what radar did in 1942 to the Luftwaffe, but no application of ultrasonics saw active service in World War I.

After that war, a tight security obscured basic findings in superaudible acoustics during the twenties and peacetime research on the subject was not encouraged. But the Navy sponsored classified projects, investigating piezoelectricity, quartz processing, synthetic crystals, and other tools for use in ultrasonics. The thirties saw the development of the integrated sonar systems used in World War II, as well as measuring devices and underwater sound standards. A wiser declassification following the late war has made most of this technical material available to interested physicists and ultrasonic applications to biological, physical, and chemical processes have increased tremendously. E.K.

Some Background History of Ultrasonics. By Elias Klein. *J. Acous. Soc. Am. 20: 601, September, 1948.*

Quanta and Vision

The paper summarized here is the second of a series of two. The first dealt with the contrast required for detecting rectangular targets of various sizes and symmetries against a large background of uniform brightness. In the first test this background brightness was about that represented by sunlit sand, water, and sky and in later tests it was the other daylight extreme, roughly equal to the prevailing light after sunset. A dozen observers, all under 30 years of age and having 20–20 vision, were given eight "looks" at each of a variety of arrangements of a target. The ratio of their success in seeing it was plotted graphically in relation to the difference in brightness between target and background. The present paper interprets these "frequency of seeing" curves in terms of the quantum nature of light and the mosaic arrangement of rods and cones in the retina.

The authors first make the assumption that a foveal cone's absorbing a light quantum is a random event, subject to the laws of chance. On this basis they conclude, from the data given, that detecting a target takes place along the perimeter of the image in the retina, that it requires the absorption of at least four quanta by one of the cones along the perimeter, and that this critical number of quanta is the same for each of the two background brightnesses investigated. At the higher brightness, this critical number of quanta absorbed from the target is about equal to the random fluctuation to be expected in the number absorbed from the background during the critical time of one exposure. E.S.L.

Size, Shape, and Contrast in Detection of Targets by Daylight Vision. II. Frequency of Seeing and the Quantum Theory of Cone Vision. By Edward S. Lamar, Selig Hecht, Charles D. Hendley, and Simon Shlaer. *J. Opt. Soc. Am. 38: 741, September, 1948.*